

pressure is aided by arterial cannulation and is highly recommended.

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### Radial Artery Cannulation

RADIAL ARTERIES are cannulated for blood gas sampling, continuous blood pressure and pulse rate monitoring, pulse wave analysis, cardiac output determinations, phlebotomy, exchange transfusions, angiography and pulse triggering of intra-aortic balloons. Thrombosis may occur in 60 percent of cannulated radial arteries. Even with complete occlusion, collateral circulation from the ulnar artery usually prevents ischemic complications. Assessment of the patency and distribution of ulnar artery collateral flow before radial artery cannulation is mandatory. Collateral flow can be measured by the modified Allen test, finger plethysmography or Doppler flow studies. In three percent of the population, collateral flow is inadequate and radial artery cannulation is contraindicated.

Measurement of wrist circumference is a reliable predictor of the risk of vascular occlusion developing. The smaller the wrist, the smaller the radial artery and the greater the likelihood of subsequent thrombosis. If the wrist circumference is less than 16 cm, the radial artery should be cannulated with small (20-gauge) catheters. The incidence of radial artery thrombosis is also directly related to the size, shape, and composition of the catheter used. In adults, 20-gauge catheters are associated with fewer cases of thrombosis than 18-gauge catheters. Untapered catheters are safer than those with tapered shafts. Teflon catheters have a lower incidence of thrombosis than similar polypropylene catheters. Finally, the occurrence of radial artery thrombosis is directly proportional to the duration of cannulation, so catheters should be removed as soon as they are no longer needed. Intermittent or continuous infusion of dilute heparin solution will prolong the patency of indwelling catheters but will not prevent eventual thrombosis. Concentrated heparin solutions will cause arterial vasoconstriction.

Care must be exercised not to inject air bubbles when flushing the catheter, and the flush solution must be injected in small volumes (less than 3 ml) at slow rates to avoid retrograde emboliza-

tion of clot material to the carotid artery. Blood removed from the catheter should not be reinjected into the artery, but should either be discarded or placed into the venous system. Catheters should be aspirated for clots periodically and during decannulation. Catheter balloon thrombectomy can also be carried out if necessary.

Ischemic complications requiring thrombectomy occur in 0.2 percent to 0.6 percent of radial artery cannulations. No major vascular complications requiring amputation occurred in one series of 4,000 cannulations. Consideration of the factors discussed makes radial artery cannulation a safe procedure.

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### Banked Autologous Blood Transfusion

WITH THE INCREASING SCARCITY of stored banked blood, it is becoming apparent that a large proportion of patients with anticipated transfusion requirements can safely donate their own blood before elective operations.

The prior deposit of a patient's own blood avoids most of the hazards associated with homologous blood transfusions. Other advantages are stimulation of erythropoiesis and conservation of donor reserves. Excessive falls in the hemoglobin level to less than 10 grams per dl can be avoided with judicious iron therapy. Plasma volume is restored 32 to 76 hours after phlebotomy.

One unit of blood can be taken every four to seven days, up to 36 hours before an operation. The blood storage time limit of 21 days can be increased to 35 days by the use of citrate-phosphate-dextrose solution, and storage time is practically unlimited with frozen red blood cells. As identification errors are still possible, a fail-proof identification system is necessary, together with serologic tests and informed consent.

Suitable candidates for autologous transfusion include most elective surgical patients in reasonably good health, although patients with coronary, valvular or congenital cardiac disease have do-

nated up to 10 units of their own blood before surgical operation. The prephlebotomy hemoglobin level should be at least 11 grams per dl. Iron should be administered orally to these patients (325 mg of ferrous sulfate three times a day)—this is as effective as parenterally given iron and less hazardous.

Patients with rare blood types, those who are difficult to cross-match, those previously alloimmunized and candidates for transplant represent special indications. Contraindications are infections or neoplasia (risk of dissemination), inability to increase red cell production in response to iron therapy, sickle cell disease, and occupations requiring intense physical exertion or hazardous duties.

It is the physician's responsibility to inform his patient about this safe, readily available and well-tolerated procedure. Hospitals and medical staff organizations should be encouraged to develop active recruitment programs.

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### Paternal Participation in Obstetrical Anesthesia

WE HAVE ENTERED an era of consumerism in medicine, especially in obstetrics. Physicians must be responsive to present-day needs in order to prevent patients from avoiding hospitals and seeking less conventional and less safe care.

It has become fashionable for fathers to be present during childbirth; this includes during labor, delivery and even cesarean section. Anesthesiologists should be aware of this and able to deal with the situation.

Whether to allow the father to be present during administration of an epidural anesthetic for labor is controversial. On the positive side, the father may be able to distract and reassure the mother. On the other hand, the father may be distressed by the large needles and occasional blood loss associated with this procedure and may respond adversely to the situation. The simplest solution is to politely ask the father to leave during the administration of the anesthetic, and to invite him to return once anesthesia has been well established. This may not necessarily be appro-

priate in all cases. Some fathers will become hostile if asked to leave and some, as mentioned previously, may even be helpful during the procedure. The ideal solution is to be sure there is good communication with the father and to allow him some freedom of choice.

If the father is to be present during administration of an epidural anesthetic, certain precautions must be taken to provide for his safety. We have had the experience of a father falling and fracturing his skull during the administration of an epidural anesthetic. If the father remains, he should be seated in a chair facing the mother. Further, his nutritional state should be determined. In the instance cited, the father had not eaten for many hours and was probably somewhat hypoglycemic and hypovolemic when overcome by the stress of the situation. We have found that most fathers who feel uncomfortable will leave the room voluntarily.

If delivery is to be by cesarean section, the situation becomes more complex. The idea of fathers being present during cesarean section has not been greeted with general enthusiasm by obstetricians and anesthesiologists. However, we must again be responsive to the needs of our patients. Many institutions have protocols that make the situation more manageable. In the first place, it must be understood by the father that he may be asked to leave at any time, either by the obstetrician or the anesthesiologist. There can be no question of this point. The father should attend some form of prepared childbirth classes, preferably those dealing directly with cesarean section. Although the question of whether fathers should be present during the administration of the anesthetic is controversial, the same considerations should apply here as during labor.

In either case, once anesthesia has been established and the mother positioned on the operating table, the father should be seated at the head of the table next to the anesthesiologist and behind the drapes. He should be reminded that he is there to support the mother and participate in the delivery and not to be an observer of surgical procedure. Again, he should be watched closely for signs of faintness. At delivery, he may be invited to the bassinet to observe the infant, and then back to the mother when the infant is brought to her. It is generally efficacious if he accompanies the infant to the nursery, which allows simpler management of the remainder of the surgical